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## MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY.

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COMMUNICATED BY E. B. TITCHENER.

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### XVII. CUTANEOUS PERCEPTION OF FORM.

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By D. R. MAJOR, PH. D.

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The object of the following experiments was the determination of the limen of form at various parts of the cutaneous surface. Although the investigation is not yet concluded, it seems worth while to publish the results so far gained: especially as there is no literature upon the subject (*cf.* Henri, *Raumw. d. Tastsinnes*, 1898, p. 53).

The forms employed were angles, open circles, filled circles and filled triangles. The *angles* (of  $35^{\circ}$ ) were made by fastening strips of sheet rubber to wooden handles. The lengths of side used were 3 to 10 mm., inclusive. The *open circles* were cut from glass tubing (thickness of glass about .5 mm.), the cut edge of which was ground. The outside diameters ranged between 2 and 11 mm. The *filled circles* were made from solid glass rods, in the same way: diameters 2 to 12 mm. The *triangles* (equilateral) were cut from hard rubber blocks, and fastened to wooden handles: sides 2 to 9 mm. In each series the increment of difference was 1 mm. The method employed was that of just noticeable stimuli, as described by Kuelpe (*Outlines of Psych.*, pp. 55 f.). The subject closed his eyes, and the form was pressed firmly down upon the skin, at the place selected. As soon as the subject had cognised (or definitely failed to cognise) a form, he opened his eyes, and drew upon paper a figure which corresponded to the cutaneous perception. The judgment of cutaneous form was thus recorded in terms of a visual translation. This procedure recommended itself in view of the fact that movement was above all things to be avoided; we were investigating the cutaneous, not the tactual appreciation of form. It may be said at once, however, that one of the subjects (G), who is of the tactual type and has small power of visualization, could hardly be restrained from movement (wrinkling the skin, shifting the fingers, etc.,) in spite of all cautions. With the other two subjects no such difficulty was found.

The subjects—Dr. I. M. Bentley (B), Dr. E. A. Gamble (G), and Dr. W. Manahan (M)—were all trained in psychological methods, and knew in a general way the object of the present enquiry. The procedure with knowledge was, of course, followed in experimentation. *B* soon became aware that only four forms were being employed; *G* and *M* showed no trace of any positive opinion on the matter. The surfaces tested were the tip of the tongue, the tip of the middle finger of the right hand, and the central portions of the red areas of upper and lower lips. It was a mistake to work upon all four with the same forms in a single investigation, since information gained from the points of greater discrimination is almost inevitably transferred to other points, whose limina are thus unduly lowered. The results proved that the dimensions taken were not small enough, in the following cases: angles, on the tongue and under lip; open circles, on the tongue; filled triangles, on the tongue. (The results from *G*, where they stand alone, throw no light on this question, for the reason given above.) On the other hand, the dimensions were too small to allow of liminal determinations on forehead, cheek, ball of thumb, and volar side of wrist. No other surfaces were tried.

*Results.* The following Tables show the results for the three subjects on the four surfaces. Under *L* is given the average form limen; under *m. v.* the average departure of the single determinations from *L*; under *no.* the number of single determinations made. It must be remembered that a single determination implies the performance of experiments in two directions, ascending and descending; so that, *e. g.*, 10 *L*'s required 20 series of experiments. The *m. v.*'s of the partial limina were very small; hence neither they nor the limina themselves are shown in the Tables. The thick figures indicate that the limit of the instrument was reached, or, in other words, that the recorded *L* may be too large.

TABLE I.  
*Tip of tongue. Unit 1 mm.*

Subject.	$\Lambda^1$			○			●			$\blacktriangle^1$		
	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.
B	5	1	8	<b>2</b>	—	4	6	1.3	3	<b>3</b>	.5	10
G	<b>3</b>	—	10	<b>2</b>	—	4	4	1	5	<b>2</b>	—	8
M	<b>3</b>	—	10	<b>2</b>	—	4	4	1	4	<b>2</b>	—	8

<sup>1</sup>On tongue and lips these figures were placed always with the apex pointing upwards or downwards upon the longitudinal axis of the body. Variation of direction made no difference in judgment. On

TABLE II.  
*Tip of finger. Unit 1 mm.*

Subject.	Λ			○			●			▲		
	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.
B	4	.7	11	3	.3	3	5	1	3	4	1	4
G	5	.8	10	2	—	4	4	.7	4	4	1.1	7
M	5	1.3	6	4	1	3	6	1.3	3	5	2.3	6

TABLE III.  
*Upper lip. Unit 1 mm.*

Subject.	Λ			○			●			▲		
	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.
B	5	.6	8	3	.5	4	6	2	5	6	2	11
G	4	.4	8	2	—	3	5	1.2	4	5	1.3	9
M	4	.6	9	3	.7	4	6	1.5	4	5	.7	6





TABLE IV.  
*Lower lip. Unit 1 mm.*

Subject.	Λ			○			●			▲		
	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.	L.	M. V.	NO.
B	4	1	5	3	.2	4	6	1.5	3	7	2.1	7
G	3	—	9	2	—	3	5	1.5	4	4	1	6
M	3	—	6	3	.3	3	6	1.7	4	7	2	5

It appears from these Tables that, within the limits of our experiments, *the surfaces tested rank*, as regards capacity of form cognition, in the order: *tip of tongue, tip of finger, lips*. (Between upper and lower lip there is no appreciable difference.) It appears further, that the cutaneous surfaces differ in their behavior according as the stimuli are surfaces or outlines: thus the lips are at a disadvantage when the filled circle and the triangle are applied. A different selection of stimuli might therefore lead to a different order of rank. The fact is brought out in Table V, which is obtained by massing the results from the three subjects.

the finger tip, all four possible positions were employed. Unfortunately, we have no separate records for the longitudinal and transverse directions. The introspective notes, however, show (for all three subjects) that cognition was subjectively a little easier when the forms lay transversely upon the surface.

TABLE V.  
*Limina of form in mm.*

PLACE.				
Tongue . . .	<b>3.7</b>	<b>2</b>	4.7	<b>2.3</b>
Finger . . .	4.7	<b>3</b>	5	4.3
Upper lip . .	4.3	<b>2.7</b>	5.7	5.3
Lower lip . .	<b>3.3</b>	<b>2.7</b>	5.7	6
Av. . . . .	4	2.6	5.3	4.5

We see from these figures that the *form most easily cognised* by the four surfaces *is the open circle*. It is, perhaps, hardly safe to draw any general conclusion from them as to the order of cognition of the remaining three forms. We may remark, however, that the filled circle was as unsatisfactory as the open circle was satisfactory to work with. This accounts for the smaller number of series given for these two forms in the Tables.

*Practice*—in some cases extending over a month—was given with each instrument for each place upon the skin. Its effect was twofold. Practice at a given spot increased the subject's power of discrimination (or rather cognition) of form at that spot.<sup>1</sup> And practice at a spot of finer discrimination was, as we have said above, of influence upon the cognition of form at spots of coarser discrimination. The latter fact is clear from our introspective records, especially from those of *B*. There can be no doubt that the influence was enhanced by the character of the method employed, *i. e.*, by the requirement of translation from haptics into optics.

It need hardly be said that the value of a limen is never an absolute value. Limina will vary as the conditions of experimentation vary. Our subjects had all had general practice, and worked according to a procedure with knowledge. While we have reason to think that the limina of these three subjects would have been practically the same if obtained by a procedure without knowledge, experiments (not yet completed) upon subjects lacking in general practice promise to give a higher limen, particularly by a procedure without knowledge. They indicate, too, that the values will differ with the admission or rejection of visualization.

*Subliminal judgments.* The following Tables show the

<sup>1</sup>The values given by Titchener (*Outline of Psychology*, p. 164)—triangle, 3.5 mm. on tongue, 7 mm. on finger-tip—are massed values taken from our three subjects at what proved to be about halfway through the stage of practice. On the theory of practice see Henri, *Raumw. d. Tastsinnes*, pp. 27 ff.; Tawney, *Phil. Stud.*, xiii, 163 ff.

nature of the subliminal judgments of form passed by the three subjects. They tell their own tale of individual tendency.

TABLE VI.  
*Subliminal judgments. Tip of tongue.*






SUBJECT.			
B		Blur.	● or blur.
G	 <sup>1</sup>	Blur.	
M	● <sup>1</sup>	Blur.	

TABLE VII.  
*Subliminal judgments. Tip of finger.*










Subject.				
B	○ or 	Blur.	●	Blur.
G	— or 	○	— or 	
M	— or 	Blur.		Blur.

TABLE VIII.  
*Subliminal judgments. Upper lip.*


















Subject.				
B	 or Blur.	Blur.	Blur.	Blur.
G	— or 	Blur.	— or ○	
M		—	● or 	Blur.

TABLE IX.  
*Subliminal judgments. Lower lip.*

Subject.				
B	 or Blur.	Blur.	Blur.	Blur.
G	— or  <sup>2</sup>	○	— or  or 	
M	● or  <sup>2</sup>	Blur.	● or 	Blur.

<sup>1</sup>In practice experiments.

<sup>2</sup>In practice experiments.